

REMARKS

Reexamination of the captioned application is respectfully requested.

A. SUMMARY OF THIS AMENDMENT

By the current amendment, Applicants basically:

1. Respectfully traverse the rejections under 35 USC §112, first paragraph (see section C infra).
2. Add new independent claims 22 and 23, which respectively replace claims 1 and 9.
3. Amend the dependencies of the remaining non-withdrawn claims for dependency upon the new independent claims.
4. Respectfully traverse all prior art rejections (see section B infra).

B. THE CLAIMS ARE DEFINITE

Applicants have replaced independent claim 1 with independent claim 22, and independent claim 9 with independent claim 23. New independent claims 22 and 23 obviate the objection appearing at the top of page 3 of the office action, it being noted that while not totally constituting the foam formulation, the claimed mixture is included in the foam formulation. Moreover, new independent claims 22 and 23 moot the rejections under 35 USC §112, second paragraph, levied in the sixth enumerated paragraph of the office action.

C. THE CLAIMS ARE ENABLED

Twice the Examiner has formulated rejections under 35 USC §112, first paragraph.

The first (April 28, 2003) rejection under 35 USC §112, first paragraph, alleged that the scope of the structure and/or materials of facers were critical or essential to the

practice of the invention, but not included in the claims. The first rejection was not maintained.

The second (September 9, 2003) rejection under 35 USC §112, first paragraph, is completely different – alleging that the amount of selected DBE and foam composition are each critical or essential, but not claimed. The same inapplicable case law was cited in both rejections.

In asserting the second rejection, the office action alleges that Applicants' specification and remarks "appear to have admitted and/or asserted that the specific amount of DBE mixture in the foaming composition is critical for the adhesion improvement" (see enumerated paragraph 4 of the office action). As an apparent but incorrect corollary, the Examiner suggested that claims 4 and 5 be incorporated into independent claim 1, and that claims 10 and 11 be incorporated into independent claim 9.

Applicants adamantly traverse the second rejection under 35 USC §112, first paragraph, and decline the suggestion to amend. The record clearly shows that Applicants have not made the alleged admissions or assertions.

Applicants' specification does state that "[t]he actual chemical compounds employed in one mode in this mixture are the methyl esters of about 59% glutaric acid, about 20% succinic acid, and about 21% adipic acid" (page 5, lines 9 – 11, and page 6, lines 9 – 11, emphasis added). Mere mention of a specific mixture employed in one mode of the invention does not constitute an admission of criticality.

Nor does Applicants' reference (in the July 9, 2003 Amendment) to a "preferred formulation" in urging patentability of dependent claims constitute an admission or assertion of criticality.

This is not a *Scimed* situation in which an applicant has ascribed to "all embodiments of the present invention" a particular configuration or formulation. There is nothing in the present specification which indicates or implies that the invention is limited only to one formulation. Quite the opposite: the wording "in one mode" and "preferred formulation" indicate that there are other modes and other formulations.

Therefore, the present allegations of unclaimed criticality are manifestly incorrect. Like the first 35 USC §112, first paragraph, rejection, the second should be withdrawn. Applicants resist any unwarranted effort to employ 35 USC §112, first paragraph, to limit claim scope unduly.

D. THE PATENTABILITY OF THE CLAIMS

Claims 1 – 13 were rejected under 35 USC §103(a) as being unpatentable over US Patent 4,335,218 to DeGuisseppi. The rationale for the rejection was the same as set forth in the previous office action. In addition, the Examiner has taken issue with one subsidiary point in Applicants' July 9, 2003 patentability remarks.

In that subsidiary point, Applicants previously stated that the dimethyl esters of the DBE are weak solvents, compared to aprotic solvents such as DMF (dimethyl formamide) and DMSO (dimethyl sulfoxide) which are powerful solvents. That DBE are weak solvents is corroborated in the attached DuPont "Technical Information" sheet which lists (on page 2) solubility parameters for seven variants of DBEs. Each of the seven listed DBEs has the same 8.3 Non-Polar rating in the Hansen system, which is about 3.7 times the Polar rating. The DuPont sheet describes "solvents" as one of four general "Applications", listing fifteen areas under Solvents where DBE can be used. Incidentally but importantly, nowhere does DuPont suggest use as an ADHESIVE.

DBE has a substantial non-polar character. The very low solvency with water further removes DBEs from the normal "Aprotic Solvents". Note that DBE solvency in

water ranges from 2.4pph to 7.5pph. On the other hand, DMF (DiMethyl Formamide), Acetone, and N-Methyl Formamide are infinitely soluble in water. Methyl Formate (at 23pph) and Methyl-Ethyl-Ketone (at 24pph) are up to 10-times more soluble in water.

A foam chemist would not consider using a poor solvent like DBE to lower surface tension. Rather, the chemist would use a strongly dipolar aprotic solvent to reduce the surface tension of a polyester polyol system.

The Examiner has now taken issue by stating that O,O-dimethyl methylphosphonate, etc., cited in col. 2, lines 34 – 53 of US Patent 4,335,218 to DeGuseppi, is a weak solvent. Applicants do not understand how or why O,O-dimethyl methylphosphonate the Examiner considers O,O-dimethyl methylphosphonate (or any of the aprotic solvents mentioned in US Patent 4,335,218 to DeGuseppi) to be "weak", and specifically request that the Examiner substantiate this allegation with evidence.

But even if it were assumed arguendo that O,O-dimethyl methylphosphonate were a weak solvent, in the actual example given DeGuseppi's Table 2 the O,O-dimethyl methylphosphonate is not used alone, but significantly is used with two other and undisputedly stronger di-polar aprotic solvents: tri(chloroethyl) phosphate (col. 7, line 10) and DMF (DiMethyl Formamide) (col. 7, line 25).

Above and beyond the foregoing, the clear fact remains that US Patent 4,335,218 to DeGuseppi does not teach or suggest Applicants' particular mixture—a mixture of the methyl esters of glutaric, succinic, and adipic acid. Even if US Patent 4,335,218 to DeGuseppi were assumed arguendo to suggest using a solution to improve adhesion, there is nothing in the record to suggest Applicants' claimed mixture. In fact, there is basis in US Patent 4,335,218 to DeGuseppi for the person skilled in the art even to conclude that a mixture of the methyl esters of glutaric, succinic, and adipic acid would degrade adhesion. DeGuseppi (col. 4, lines 44 – 62) attributes a problem in adhesion to

use of a certain type of polyol that is utilized in the foam forming blend – polyester polyols. That is, polyester polyols present more adhesion problems than polyether polyols. The polyester polyols are so polar that they tend not to mix well with pentane, and do not form a good mixture. So the person skilled in the art would expect that the DibasisEsters (DBE: e.g., a mixture of the methyl esters of glutaric, succinic, and adipic acid) would exacerbate the adhesion problem if used with polyester polyols, and accordingly would not use the claimed mixture.

Rather, the person skilled in the art would conclude from references such as US Patent 5,114,985 that DBE has no positive effect on adhesion. As discussed on the first full paragraph of page 3 of Applicants' specification, examples cited in US Patent 5,114,985 indicate that the peculiar foam formulations therein employed with DBE showed no better adhesion than those without DBE. Yet, contrary to prior expectation, with Applicants' mixture and foam formulations, however, adhesion is improved.

Applicants respectfully reiterate that US Patent 4,335,218 to DeGuisseppi does not teach or suggest the claimed subject matter, and therefore request that the prior art rejections be withdrawn. Moreover, Applicants note that dependent claims 20 and 21 have not sustained prior art rejections.

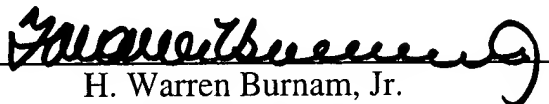
E. MISCELLANEOUS

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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DuPont Nylon

Esters

Dibasic Esters (DBE)

Product Description

Dibasic esters (DBEs) are refined dimethyl esters of adipic, glutaric, and succinic acids. The primary product is designated DBE. DBE is further distilled to produce six DBE fractions for specialty applications: DBE-2, DBE-3, DBE-4, DBE-5, DBE-6, and DBE-9. DBEs are clear, colorless liquids having a mild, agreeable odor. They are readily soluble in alcohols, ketones, ethers, and many hydrocarbons, but are only slightly soluble in water and higher paraffins.



Applications

Solvents

Industrial coatings
Coil/sheet coatings
Waterborne coatings
Magnet wire coatings
Automotive coatings
Industrial cleaners
Resin cleanup
Hand cleaners
Paint removers
Foundry core binders
Printing inks
Textile lubricants
Magnetic memory disc coatings
Urethane reaction solvents
Peroxide solvents

Plasticizers

Fugitive
Permanent diester and polyesters

Polymer Intermediates

Polyester polyols for urethanes
Wet-strength paper resins
Polyester resins

Specialty Chemical Intermediates

Quinacridone pigments

Storage and Handling

Dibasic esters are readily available from DuPont in large quantities (million lb/yr) for growth applications.

Shipping Name—Dibasic ester mixture

Freight Classification—Resin solvents, NOIBN

DOT Classification—These products are not classified as hazardous materials.

Packages

Tank Trucks—45,000 lb net wt.

Tank Car—170,000 lb net wt.

Drums—523 lb gross wt.
485 lb net wt.

General Information

Typical Compositions (wt%)	DBE	DBE-2, DBE-2SPG	DBE-3	DBE-4	DBE-5	DBE-6	DBE-9
Dimethyl Adipate	21	24	89	—	0.1	98.7	0.2
Dimethyl Glutarate	59	75	10	0.3	99	<0.5	66
Dimethyl Succinate	20	0.3	0.2	98.4	0.4	<0.1	33
Methanol	0.2	0.01	0.05	0.01	0.02	0.03	0.01
Water	0.05	0.02	0.04	0.02	0.03	0.03	0.04
Physical Properties							
Molecular Weight	159 ^a	163 ^a	173 ^a	146	160	174	156 ^a
Sp. Gr. at 20/20°C ^b	1.092 ^c	1.081 ^c	1.068 ^c	1.121	1.091	1.064	1.099 ^c
Density at 20°C (lb/gal)	9.09 ^c	9.00 ^c	8.89 ^c	9.33	9.08	8.86	9.15 ^c
Distillation Range, °C	196–225	210–225	215–225	196	210–215	227–230	196–215
Vapor Pressure at 20°C (Torr)	0.2 ^c	0.1 ^c	0.06 ^c	0.3	0.1	<0.05	0.3 ^c
Solubility in Water wt% at 20°C	5.3	4.2	2.5	7.5	4.3	2.4	–5
Water Solubility in DBEs wt% at 20°C	3.1	2.9	2.5	3.8	3.2	2.4	–3.5
Freezing Point, °C	–20 ^c	–13 ^c	8	19	–37	10	–10 ^c
Flash Point, Tag Closed Cup °C (°F)	100 (212)	104 (219)	102 (216)	94 (200)	107 (225)	113 (235)	94 (202)
Auto Ignition Temp., °C	370	375	360	365	365	N/A	365
Latent Heat of Vaporization, cal/g	81	80	79	85	81	79	82
Viscosity at 25°C, cst.	2.4	2.5	2.5	2.5	2.5	2.5	2.4
Solvent Properties							
Solubility Parameters ^d							
Nonpolar	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Polar	2.3	2.2	2.1	2.5	2.3	2.1	2.3
Hydrogen Bonding	4.8	4.7	4.5	5.0	4.8	4.5	4.8
Surface Tension at 20°C, dynes/cm	35.6	N/A	N/A	N/A	N/A	N/A	N/A
Electrical Resistance ^e at 24°C, megohms	0.5	N/A	N/A	N/A	N/A	N/A	N/A
Specifications							
Ester Content, wt% min.	99.0	99.0	99.0	98.5	99.0	99.0	99.0
Water Content, wt% max.	0.10	0.10	0.20	0.04	0.10	0.05	0.10
Acid Number, max.	0.30	1.00	1.00	0.50	0.50	1.00	0.50
Composition Range							
Dimethyl Adipate	10–25	20–28	85–95	0.1 (max.)	0.2 (max.)	98.5 (min.)	0.3 (max.)
Dimethyl Glutarate	55–65	72–78	5–15	0.4 (max.)	98.0 (min.)	1.0 (max.)	65–69
Dimethyl Succinate	15–25	1.0 (max.)	1.0 (max.)	98.0 (min.)	1.0 (max.)	0.15 (max.)	31–35

^a Average for mixture

^b Δsp. gr./ΔT = –0.0007 per °C over the range 20–50°C

^c Approximate, based on composition

^d Hansen Solubility Theory

^e Ransberg Paint Resistance Tester Model 219CB

For Samples and Information:

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Solvents

Introduction

The vast majority of chemical reactions are performed in solution. The solvent fulfills several functions during a chemical reaction. It solvates the reactants and reagents so that they dissolve. This facilitates collisions between the reactant(s) and reagents that must occur in order to transform the reactant(s) to product(s). The solvent also provides a means of temperature control, either to increase the energy of the colliding particles so that they will react more quickly, or to absorb heat that is generated during an exothermic reaction. The selection of an appropriate solvent is guided by theory and experience. Generally a good solvent should meet the following criteria.

- It should be inert to the reaction conditions.
- It should dissolve the reactants and reagents.
- It should have an appropriate boiling point.
- It should be easily removed at the end of the reaction.

The second criterion invokes the adage "Like dissolves like". Non-polar reactants will dissolve in non-polar solvents. Polar reactants will dissolve in polar solvents. For our purposes there are three measures of the polarity of a solvent:

1. Dipole moment
2. Dielectric constant
3. Miscibility with water

Molecules with large dipole moments and high dielectric constants are considered polar. Those with low dipole moments and small dielectric constants are classified as non-polar. On an operational basis, solvents that are miscible with water are polar, while those that are not are non-polar; remember the saying "Oil and water don't mix".

Chemists have classified solvents into three categories according to their polarity.

1. polar protic
2. dipolar aprotic
3. non-polar.

Polar Protic Solvents

Let's start with the meaning of the adjective protic. In the context used here, protic refers to a hydrogen atom attached to an electronegative atom. For our purposes that electronegative atom is almost exclusively oxygen. In other words, polar protic solvents are compounds that can be represented by the general formula ROH. The polarity of the polar protic solvents stems from the bond dipole of the O-H bond. The large difference in electronegativities of the oxygen and the hydrogen atom, combined with the small size of the hydrogen atom, warrant separating molecules that contain an OH group from those polar compounds that do not. Examples of polar protic solvents are water (HOH), methanol (CH₃OH),

and acetic acid ($\text{CH}_3\text{CO}_2\text{H}$).

Dipolar Aprotic Solvents

Here the key word is aprotic. In the context used here, aprotic describes a molecule that does not contain an O-H bond. Solvents in this class all contain a bond that has a large bond dipole. Typically this bond is a multiple bond between carbon and either oxygen or nitrogen. Most dipolar aprotic solvents contain a C-O double bond. Examples are acetone [$(\text{CH}_3)_2\text{C}=\text{O}$] and ethyl acetate ($\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$).

Non-Polar Solvents



Non-polar solvents are compounds that have low dielectric constants and are not miscible with water. Examples include benzene (C_6H_6), carbon tetrachloride (CCl_4), and diethyl ether ($\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$).

Table 1 presents a list of solvents that are commonly used in chemical reactions. The boiling point, dipole moment, and dielectric constant of each solvent is included. All of these solvents are clear, colorless liquids. The hydrogen atoms of the protic solvents are highlighted in red.

Table 1

Common Solvents for Organic Reactions

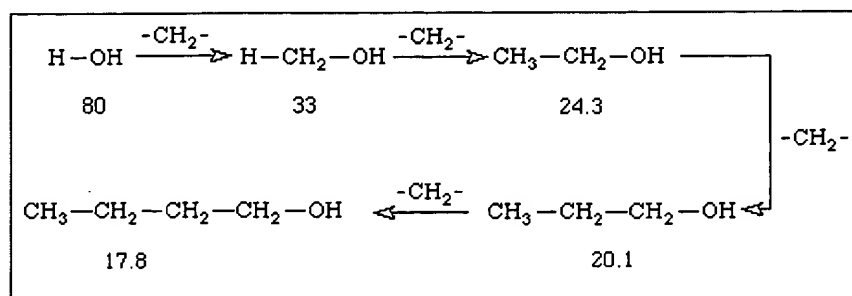
Name	Structure	bp, °C	dipole moment	dielectric constant
water	H-OH	100	1.85	80
methanol	$\text{CH}_3\text{-OH}$	68	1.70	33
ethanol	$\text{CH}_3\text{CH}_2\text{-OH}$	78	1.69	24.3
1-propanol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{-OH}$	97	1.68	20.1
1-butanol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{-OH}$	118	1.66	17.8
formic acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}-\text{C}-\text{OH} \end{array}$	100	1.41	58
acetic acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_3\text{C}-\text{C}-\text{OH} \end{array}$	118	1.74	6.15
formamide	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}-\text{C}-\text{NH}_2 \end{array}$	210	3.73	109
oooo	oooo	oooo	oooo	oooo
acetone	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_3\text{C}-\text{C}-\text{CH}_3 \end{array}$	56	2.88	20.7
methyl ethyl ketone		80	2.78	18.5

	$\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2\text{CH}_3$			
ethyl acetate	$\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OCH}_2\text{CH}_3$	78	1.78	6.02
acetonitrile	$\text{H}_3\text{C}-\text{C}\equiv\text{N}$	81	3.92	36.6
N,N-dimethylformamide (DMF)	$\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{N}(\text{CH}_3)_2$	153	3.82	38.3
dimethyl sulfoxide (DMSO)	$\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{S}}-\text{CH}_3$	189	3.96	47.2
oooo	oooo	oooo	oooo	oooo
hexane	$\text{CH}_3(\text{CH}_2)_4\text{CH}_3$	69	----	2.02
benzene		80	0	2.28
diethyl ether	$\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$	35	1.15	4.34
tetrahydrofuran (THF)		66	1.63	7.52
methylene chloride	CH_2Cl_2	40	1.60	9.08
carbon tetrachloride	CCl_4	76	0	2.24

It should be apparent from the table that there are no sharp boundaries between polar and non-polar solvents, at least if you use dielectric constants or dipole moments as a measure. There is, however, a correlation between chemical structure and dielectric constant that provides a useful way to think about polarity. Look at the series of polar protic compounds water, methanol, ethanol, 1-propanol, and 1-butanol. As Figure 1 demonstrates, each compound in the series differs from the ones before and after it by one CH_2 group.


Figure 1

Structure-Property Correlations



As the number of CH_2 groups in ROH increases, the dielectric constant decreases. If you think of these molecules as containing a polar component (OH) and a non-polar component (R), then the polarity of a compound reflects the balance between these two components. As the relative amount of hydrocarbon character increases, the polarity decreases. Note that hexane, which is 100% hydrocarbon, is the least polar solvent in the table.

Exercise 1 Classify each of the following solvents as polar protic (P), dipolar aprotic (D), or non-polar (N) by entering the appropriate letter in the text field next to each structure.

CHCl_3 <input type="text"/>	$\text{C}_6\text{H}_5\text{Cl}$ <input type="text"/>	$\text{HCO}_2\text{CH}_2\text{CH}_3$ <input type="text"/>
CF_3COCF_3 <input type="text"/>	$\text{CF}_3\text{CH}(\text{OH})\text{CF}_3$ <input type="text"/>	$(\text{CH}_3)_2\text{N}-\text{P}(\text{O})-\text{N}(\text{CH}_3)_2$ <input type="text"/>
 <input type="text"/>	NH_2NH_2 <input type="text"/>	$\text{CF}_3\text{COCOCF}_3$ <input type="text"/>
$\text{CF}_3\text{CO}_2\text{H}$ <input type="text"/>	$\text{C}_6\text{H}_5\text{CH}_3$ <input type="text"/>	$\text{CH}_3\text{CH}_2\text{CN}$ <input type="text"/>

Now that we've looked at the various types of solvents that you can expect to see, let's examine how those solvents interact with solutes.

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